FIGHT'S ON!

AFRL/HEA Joins Forces with USAF Weapons School

The week of 22 April 2002 marked a red letter milestone event at Mesa Research Site, when the USAF Weapons School (USAFWS) F-16 Division Instructor Pilots (IP) brought Weapons Instructor Course (WIC) Class 02A to fly simulated Distributed Mission Training (DMT) scenarios. The WIC students flew five DMT sorties each in the F-16C Block 30 "Viper" four-ship at Mesa, flying synthetic missions over the Nellis Range Complex as mission rehearsal opportunities prior to their live-fly Weapons Phase at Nellis AFB NV.

AFRL/HEA's long-standing relationship with the USAFWS began in late 1998. Initial briefings were by ACC/DR on the Command's DMT implementation plans, and AFRL/HEA on Mesa's ongoing role in conducting warfighter training research in the DMT Testbed. After some preliminary exploration of training opportunities at Mesa during 2000, the

USAFWS F-16 Division used the DMT Testbed to validate employment and targeting standards prior to live-fly at Nellis.

From Nellis AFB NV, USAFWS WIC Class 02A pilots, USAFWS instructor pilots, and USAFWS weapons controller with members of the 414th CTS Advanced Weapons Director School--Pilots rotated mid-week to ensure all WIC students had mission rehearsal experience prior to the Weapons Phase.

Capt Craig "Bluto" Baker, USAFWS F-16 Division instructor pilot, evaluates performance of WIC Class 02A pilots in the Viper four-ship from the DMT console in preparation for thorough debriefings in Mesa's digital debrief facility.

These standards, flown by line F-16 pilots and orchestrated by F-16 Division IPs working from the DMT Control Station console at Mesa, quickly proved the training value of high-fidelity simulation enabling multi-ship, multi-group engagements in a realistic, non-permissive (hostile) environment.

With the concurrence of ACC/DR and USAFWS, AFRL/HEA soon began supporting WIC Spin-up training research for F-16 pilots selected to attend USAFWS. A concerted effort to "get the word out" resulted in a majority of the ten Viper pilots selected for each of the past two semi-annual WIC classes coming to Mesa to cycle through the DMT Testbed prior to reporting to Nellis.

While research data continues to accumulate with WIC-select pilots now routinely flying in the DMT Testbed, AFRL/HEA scientists and USAFWS F-16 IPs collaborate to refine the training to enhance preparation for each pilot.

With only preliminary analysis of the training research data, AFRL/HEA subject-matter experts, in conjunction with AFRL/HEA scientists, front-line F-16 IPs, and USAFWS IPs, developed three robust DMT syllabi for recurring training research efforts. These syllabi are Mission Essential Competency (MEC) driven. Systematic linkage of Air Force Mission Essential Task Lists and Training Task Lists are applied to hone higher-order individual and team competencies needed to fully prepare warfighters for successful mission completion under adverse conditions in a non-permissive environment. MEC-based training advantages ensure a common reference for integrated training, and Mesa's DMT Testbed affords more exposure to multi-ship operations with syllabi designed to "raise the bar" for warfighter performance.

Recognizing that the Mesa DMT Testbed has benefited more than 250 F-16 pilots and the weapons directors who control the Viper four-ship during a typical DMT week, the USAFWS has made a significant commitment to high-fidelity realistic simulation. The USAFWS has found the DMT experience so effective in improving complex mission skills, such as decision-making and situational awareness, that the F-16 Division has formally written a week of DMT into its new syllabus. While five

Capt Val "Bam Bam" Arbogast, student in USAFWS WIC Class 02A, prepares to brief his Viper flight for a Weapons sortie in the DMT Testbed.

sorties flown as mission rehearsal for the Weapons Phase of WIC Class 02A were squeezed into their training program, the pilots of WIC Class 02B are scheduled to return to Mesa in September 2002. Starting with WIC Class 02B, pilots will fly up to nine complex simulation periods each while ramping up for the Tactical Intercept/ Air Combat Tactics Phase at Nellis.

As DMT capabilities grow in the Combat Air Forces, the training research conducted at Mesa helps guide efforts to integrate high-fidelity simulation with live-fly operations. With an eye on future combat requirements, AFRL/HEA envisions warfighters supplementing their available live-fly sorties with complex engagements flown in a full-mission capable synthetic environment to maximize the benefit of MEC-based readiness training. Every flying hour counts, and ensuring warfighters possess the demanding higher-order mission skills required to perform in complicated coalition operations is the common goal of MEC-based training and ongoing DMT research. With the USAFWS as a partner, AFRL/HEA is proud to lead the way!

Electronic Warfare Training System Passes Test

AFRL/HEA conducted integration and testing of the Next Generation Threat System (NGTS), a simulation of the AN/ALR-69 Radar Warning Receiver (RWR), developed by the laboratory under an AETC Education and Training Technology Application Program. During an extensive demonstration at Kirtland AFB NM, the NGTS team pulsed information from the NGTS to an actual AN/ALR-69 system mounted on a test bench in the Electronic Warfare (EW) maintenance shop of the 58th Special Operations Wing. The NGTS transmitted the RWR signals, flawlessly passing real-time data from the NGTS operator through the MIL STD 1553 card and exactly reflected on the aircraft AN/ALR-69 display. With AFSOC, USSOCOM, and STRICOM warfighters in attendance, the "Operational Utility Evaluation of the AN/ALR-69 Imbedded Electronic Warfare System" was underway, and ended with an AFSOC member stating, "I regard this system (having actually SEEN it) as a great tool and an EW mission planning/rehearsal resource without equal."

The NGTS was developed at the nominal cost of $400K using commercially available aircraft certified hardware. The software development effort relied extensively on existing code, and the resulting RWR replication is a bit-level accurate representation of the actual device. The RWR replication is currently used in the F-16 Block 30 Multi-Task Trainers (MTT) in the DMT Testbed, as well as ANG/AFRC F-16 Block 30 MTTs and A-10 Full-Mission Trainers. The realism of this RWR is the motivation behind embedding the system on an aircraft, as it allows the ability to bypass parts of the actual system that were not designed to function in a simulated environment.

The prototype system permits extensive on-demand EW training without relying on threat arrays on weapons ranges, which are becoming increasingly scarce due to cost and environmental concerns. The on-board self-contained training system includes its own Digital Terrain Elevation Data (DTED) database, geographically correlated to where the aircraft is operating. This real-time capability contrasts with the approximately 20 minutes it takes to build an 18 geo-cell database directly from National Imagery and Mapping Agency supplied DTED, greatly reducing mission planning and rehearsal preparation. Also, the NGTS correlates threats exclusively using Defense Intelligence Agency-approved intelligence data integrated with the RWR display to provide the aircrew a realistic EW assessment.

The NGTS is controlled with a user-friendly operating station that permits the full range of training tasks to be accomplished. While the system has proven excellent in the DMT environment, integrating the NGTS on an aircraft and stimulating the AN/ALR-69 in real-time during flight is a significant challenge. In the Fall of 2002, the team plans

The NGTS accurately simulates emissions from ground-based threats, such as this SA-8 Surface-to-Air missile.

to integrate the aircraft navigation system with the NGTS and static test in an aircraft for fit, compatibility, and electro-magnetic interference. With the development program on track, closing the loop with the appropriate aircraft avionics will enable the NGTS to perform as an on-board electronic warfare trainer for the MC-130P Combat Shadow/King aircraft.

Aechelon Technology Demonstrates pC-Nova™ Image Generator

Under a Cooperative Research and Development Agreement (CRADA) with Aechelon Technology, Mesa's DMT Testbed hosted the pC-Nova Image Generator demonstration. This breakthrough system uses commercial-off-the-shelf PC-based processors, cables and video cards/drivers. Prior to this unveiling, Aechelon experts had displayed the pC-Nova as a stand-alone demonstration. With the 8-channel pC-Nova driving the image generation and visual displays of Viper 1, Mesa's simulation engineers and training research scientists

marveled at the significant capability of the system to display color visual out-the-window views and realistically simulate aircraft cockpit sensor displays (night vision goggle, forward-looking infrared, etc.) in a multi-spectral correlated database.

Typically, the low-end "PC" world of hardware lacks the physical capability to attain high fidelity realtime image generation adequate for fast mover military jet simulation training. Aechelon Technology's successful demonstration rivaled high-end, high-cost image generators in the ability to generate images within the photorealistic database. Developmental engineers, Nacho Sanz-Pastor and David Morgan, along with Javier Castellar, are working on improvements for the next iteration of this system as part of the CRADA process. Future applications of this technology may yield dramatic improvements in system flexibility, maintainability, and supportability at significantly reduced costs.

(l-r) Dr. Liz Martin, Night Vision Lead Scientist, with Aechelon Technology members Nacho Sanz-Pastor, Javier Castellar, John Quinn (CEO), and David Morgan demonstrating the pC-Nova Image Generator during the system's public debut at Mesa Research Site.

Photo of Aechelon Technology's pC-Nova image generation display of Nellis AFB NV; note detailed airfield environment, terrain features, and horizon view out to 180 KM.

TARGETS OF OPPORTUNITY

Capt Dave Rodriguez and representatives from AFRL/HEA and Aptima, Inc. will participate in assessment efforts during Joint Experimental Force Exercise (JEFX) Spiral 3, to identify initial performance indicators for assessing competency levels of **Aerospace Operations Center (AOC)** operators and the effectiveness of AOC training. AFRL/HEA will also provide input to JEFX management on training and manning issues regarding the effectiveness of the experiment.

AFRL/HEA managers also met with the 720th Special Tactics Group in ongoing discussions with HQ AFSOC to define the way ahead in developing robust mission training and rehearsal capability for the Combat Controller community. Funded in-house by AFRL/HEX, AFRL/HEA and HEC are collaborating to target deficiencies in **Combat Controller training** and crew interface technologies between now and an FY04 Program Objective Memorandum submission.

A number of US Air Force members from AFRL/HEA (Mesa, AZ), SECAF, HQ USAF, and HQ Air Combat Command, joined by representatives from many US industries, attended the first-ever **NATO Symposium** on "Aircrew Mission Training Through the Use of Distributed Simulation" held in Brussels, Belgium, 3-5 April 2002. The symposium was sponsored by the NATO Studies, Analysis,

and Simulation Panel (SAS) Task Group 038 for the purpose of fostering an awareness of the potential for realistic coalition training using distributed simulation. The three-day forum, an international affair attended by all NATO and Partners for Peace member nations, consisted of technical papers condensed into 25-minute presentations by AFRL/HEA, HQ USAF, HQ ACC, and US industries associated with the USAF DMT Mission Training Centers. A continuing NATO effort centers on the SAS-034 Task Group, Mission Training via Distributed Simulation, whose objective is to link more than 20 sites in Britain, Canada, France, Italy, The Netherlands, and the USA to conduct a Combined Air Operations exercise in February 2004. AFRL/HEA members have key leadership roles in the SAS-034 Task Group: Dr. Herb Bell is Chairman of the Assessment Task Team, and Mr. David Greschke is Chairman of the Technical Task Team.

Congressional staffers from Rep. J.D. Hayworth's (R-AZ-06) offices visit Mesa Research Site for mission orientation and discussions on infrastructure support. (l-r), Lt Col Stu Rodgers, Deputy Chief; Ms. Jill Henriques, Rep. Hayworth's Washington DC office; Col Jerry Straw, then Division Chief; Ms. Christine Quinn, Rep. Hayworth's East Valley Office; and Dr. Dee Andrews, AFRL/HEA Technical Advisor.

BRIEFS and DEBRIEFS

The automated **Performance Effectiveness/Evaluation Tracking System (PETS)** used to extract objective research data during DMT Testbed engagements was updated this quarter. Early indications suggest significant learning improvements during the course of a DMT research week, with each of the three DMT syllabi flown by warfighter teams. PETS automatically analyzes certain key data, such as number of Red air strikers reaching their target, percentage of Red air threats killed by the Viper flight, and the percentage of dogfight engagements caused by loss of beyond visual range

targeting success prior to the merge. An upcoming feature of PETS will extract each Viper's shot log, a key component of understanding complex flight interactions during mission debriefs.

AFRL/HEA managers attended a strategy meeting hosted by the 39th IOS at Hurlburt Field FL to formulate a plan for kick off and execution of the newly awarded SBIRs for **Information Operations (IO) and Information Warfare (IW).** Work dovetails with AFRL/HEX in-house funded efforts for IO/IW beginning in FY03, and integrates IO/IW flight operations and operators in the process.

Col Curtis Papke is the new Commander, AFRL Det 13, Mesa Research Site, and Chief, Warfighter Training Research Division. Col Papke comes to AFRL/HEA from

Patrick AFB FL, where he served as Director of Advanced Technology Applications at the Air Force Technical Applications Center, leveraging advancements in remote sensing technologies to deliver new capabilities into the hands of the warfighter. Col Papke applies a wealth of operational and testing expertise to the Division's R&D mission; he has flown the A-10 in Europe and Korea, instructed at the USAF Weapons School, and following graduation from the USAF Test Pilot School, tested and evaluated many weapons systems in the USAF inventory. He earned his bachelor and master of science degrees in aerospace engineering from Purdue University, and entered active duty in 1981. He is a command pilot with more than 2,900 hours in the A-10, F-16, F-4, T-37, and T-38.

Capt Greg Sidor leads discussion of Mesa's digital debrief system capabilities with AFOSR visitors, Dr. Lyle Schwartz (seated center), AFOSR/CC, flanked by Dr. Gen Haddad, Director of Chemistry and Life Sciences, and Dr. Clifford Rhoades, Director of Mathematics and Space Sciences.